

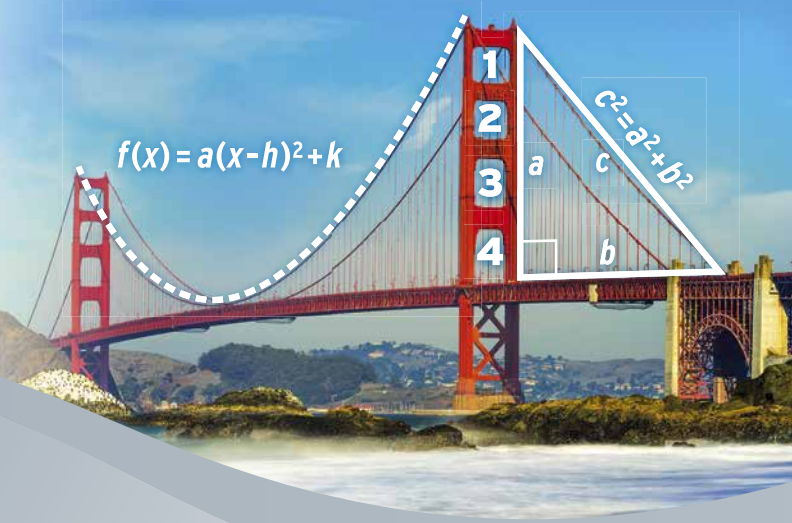


NATIONAL COUNCIL OF  
TEACHERS OF MATHEMATICS

PREMIER MATH EDUCATION EVENT

# 2016 NCTM ANNUAL MEETING & EXPOSITION

April 13-16 • San Francisco



## Building a Bridge to Student Success

Join your peers in San Francisco at the country's leading math education event, where NCTM brings together thousands of education professionals to spur the exchange of ideas, present innovations in mathematics teaching, and drive quality learning practices that benefit you and your students.

- Explore hundreds of sessions and exhibits to advance your growth and career as an educator.
- Discover more about the latest teaching trends and topics in mathematics from pre-K-12.
- Gain exposure to fresh ideas to bring back to your classroom.
- Engage, learn, and network with your colleagues from around the nation.

Registration  
Now Open!

### THE NCTM ANNUAL MEETING & EXPOSITION IS IDEAL FOR:

PRE-K-12 TEACHERS

MATH TEACHER EDUCATORS

NEW AND PROSPECTIVE TEACHERS

MATH COACHES AND SPECIALISTS

MATH RESEARCHERS

SCHOOL AND DISTRICT  
ADMINISTRATORS

Learn more at [nctm.org/annual](http://nctm.org/annual) and follow us on      #NCTMannual

## editorial panel

**Jane M. Wilburne**, Penn State Harrisburg, Hershey, Pennsylvania;  
*Chair*

**Cathy Martin**, Denver Public Schools, Colorado;  
*Board of Directors Liaison*

**Wendy Bray**, Florida State University, Tallahassee

**Zachary Champagne**, Florida State University, Tallahassee

**Ralph Connelly**, Ontario, Canada

**Pamela Gruzynski**, Bloomington District 13, Hoffman Estates, Illinois

**Susie Katt**, Lincoln Public Schools, Nebraska

**Maureen Neumann**, University of Vermont–Burlington

**Drew Polly**, University of North Carolina–Charlotte; *Digital Liaison*

**Cathery Yeh**, California State University–Fullerton

## journals staff

**Ken Krehbiel**, *Associate Executive Director for Communications*

**Joanne Hodges**, *Senior Director of Publications*

**Elizabeth M. Skipper**, *Journal Editor*

**Luanne M. Flom**, *Copy Editor*

**Sheila J. Barker**, *Review Services Assistant*

**Christine Noddin**, *Publications Assistant*

**Rick Anderson**, **Gretchen Smith Mui**, **Tara Slesar**,

**Pamela Grainger Tilson**, *Contributing Editors*

To contact a journal staff member, email [tcm@nctm.org](mailto:tcm@nctm.org).



NATIONAL COUNCIL OF  
TEACHERS OF MATHEMATICS

## advertising staff

**Elizabeth Barrett**, *National Sales Manager, The Townsend Group*  
[ebarrett@townsend-group.com](mailto:ebarrett@townsend-group.com); (301) 215-6710, ex. 114

## NCTM board of directors

**Diane J. Briars**, Pittsburgh, Pennsylvania; *President*

**Matthew R. Larson**, Lincoln Public Schools, Nebraska; *President-Elect*

**Robert M. Doucette**, NCTM, *Executive Director*

**Jennifer Bay-Williams**, University of Louisville, Kentucky

**Nadine Bezuk**, San Diego State University, California

**Florence Glanfield**, University of Alberta, Edmonton

**Paul Kelley**, Anoka High School, Anoka, Minnesota

**Cathy Martin**, Denver Public Schools, Colorado

**Ruth Harbin Miles**, Falmouth Elementary School, Stafford, Virginia

**Jane Porath**, Traverse City East Middle School, Michigan

**John SanGiovanni**, Howard County Public Schools, Maryland

**Denise A. Spangler**, University of Georgia, Athens

**Marilyn E. Strutchens**, Auburn University, Alabama

**Trena L. Wilkerson**, Baylor University, Waco, Texas

**Rose Mary Zbiek**, Pennsylvania State University, University Park

**Mission Statement:** The National Council of Teachers of Mathematics is the public voice of mathematics education, supporting teachers to ensure equitable mathematics learning of the highest quality for all students through vision, leadership, professional development, and research.

**Teaching Children Mathematics (TCM)**, an official journal of the National Council of Teachers of Mathematics (NCTM), supports the improvement of pre-K–grade 6 mathematics education by serving as a resource for teachers so as to provide more and better mathematics for all students. It is a forum for the exchange of mathematics ideas, activities, and pedagogical strategies, and for sharing and interpreting research. NCTM publications present a variety of viewpoints. The views expressed or implied in *TCM*, unless otherwise noted, should not be interpreted as official positions of NCTM. The appearance of advertising in NCTM's publications and on its websites in no way implies endorsement or approval by NCTM of any advertising claims or of the advertiser, its product, or services. NCTM disclaims any liability whatsoever in connection with advertising appearing in NCTM's publications and on its websites.

**All correspondence** should be addressed to *Teaching Children Mathematics*, 1906 Association Drive, Reston, VA 20191-1502. Manuscripts should be prepared according to the *Chicago Manual of Style* and the United States Metric Association's *Guide to the Use of the Metric System*. No author identification should appear on the manuscript; the journal uses a blind-review process. To send submissions, access [tcm.msubmit.net](http://tcm.msubmit.net). Send letters to the editor to [tcm@nctm.org](mailto:tcm@nctm.org).

**Permission to photocopy** material from *Teaching Children Mathematics* is granted to persons who wish to distribute items individually (not in combination with other articles or works), for educational purposes, in limited quantities, and free of charge or at cost; to librarians who wish to place a limited number of copies on reserve; to authors of scholarly papers; and to any party wishing to make one copy for personal use. Permission must be obtained to use journal material for course packets, commercial works, advertising, or professional development purposes. Uses of journal material beyond those outlined above may violate U.S. copyright law and must be brought to the attention of the National Council of Teachers of Mathematics. For

a complete statement of NCTM's copyright policy, see the NCTM website, [www.nctm.org](http://www.nctm.org).

For information on **article photocopies** or **back issues**, contact the Customer Care Department in the headquarters office.

The **index** for each volume appears online with the May issue. A cumulative index appears on the NCTM Web site at [www.nctm.org](http://www.nctm.org). *Teaching Children Mathematics* is indexed in *Academic Index*, *Biography Index*, *Contents Pages in Education*, *Current Index to Journals in Education*, *Education Index*, *Exceptional Child Education Resources*, *Literature Analysis of Microcomputer Publications*, *Media Review Digest*, and *Zentralblatt für Didaktik der Mathematik*.

Information is available from the Headquarters Office regarding the three **other official journals**, the *Mathematics Teacher*, *Mathematics Teaching in the Middle School*, and the *Journal for Research in Mathematics Education*. Dues support development, coordination, and delivery of NCTM's services. Dues for individual membership are \$81 (U.S.) and include \$37 for a *Teaching Children Mathematics* subscription. Each additional school

journal (*Mathematics Teacher* and *Mathematics Teaching in the Middle School*) subscription is \$37. Each additional subscription to the *Journal for Research in Mathematics Education* is \$61. **Foreign subscribers**, add \$18 (U.S.) postage for the first journal and \$4 (U.S.) postage for each additional journal. Special rates for students, institutions, bulk subscribers, and emeritus members are available from the Headquarters Office.

*Teaching Children Mathematics* (ISSN 1073-5836) (IPM 1124463) is published monthly except June and July, with a combined December/January issue, by the National Council of Teachers of Mathematics at 1906 Association Drive, Reston, VA 20191-1502. Periodicals postage is paid at Herndon, Virginia, and at additional mailing offices.

**POSTMASTER:** Send address changes to *Teaching Children Mathematics*, 1906 Association Drive, Reston, VA 20191-1502. Telephone: (703) 620-9840; orders: (800) 235-7566; fax: (703) 476-2970; email: [nctm@nctm.org](mailto:nctm@nctm.org); World Wide Web: [www.nctm.org](http://www.nctm.org).

Copyright © 2015, the National Council of Teachers of Mathematics, Inc. Printed in the U.S.A.

# news & views

## Common Core brief: The fraction progression\*

LISA ENGLAND

The Progressions Documents of the Common Core State Standards for Mathematics (CCSSM) (CCSSI 2010) present narratives that detail the progression of a math topic and how knowledge of each topic develops across grade levels. The progression for fractions describes how students build on early experiences with partitioning to extend their understanding of number and operations.

### Grades 1–3

In grades 1 and 2, students engage in preliminary geometry work focused on creating equal parts and identifying the whole. They partition shapes into halves, thirds, and fourths; reason about the relationship between the number of shares and the size of each share; and recognize that equal shares need not have the same shape.

Instruction in grade 3 quickly transitions from area models to the number line, a linear measurement model where numbers are placed according to their distance from zero. The whole to be partitioned equally is the length of the interval between zero and one. The progression begins by defining the unit fraction and then extends what students know about collections of whole numbers to collections of unit fractions.

### Counting

Just as students counted ones, they can count unit fractions, that is, a number,  $1/b$ , that represents one part when the whole has been partitioned into  $b$  equal parts. Using the number line, students



can count one-third, two-thirds, three-thirds, four-thirds, five-thirds. They notice that three-thirds falls in the same place as the number 1 and that four-thirds falls in the same place as  $1\frac{1}{3}$ , building understanding of equivalence without the need for algorithms or “improper” fractions.

### Comparing

Just as with whole numbers, students understand order on the number line in terms of length and position, where a number on the left is smaller than a number on the right because the seg-

ment from zero to the number is shorter. Students understand that fewer copies of the same unit make a lower number. When comparing different unit fractions, they reason that the higher denominator represents a lower number because the same whole is partitioned into more parts, making each part smaller.



### Addition

Just as students added ones, they can add unit fractions; so, if 5 represents 5 copies of 1, then  $5/4$  represents 5 copies of  $1/4$ , and  $5/4 + 7/4$  is  $(5 + 7)$  copies of  $1/4$ . Students recognize

### MORE WAYS TO CONNECT WITH TCM

- Submit feature and department manuscripts: [tcm.msubmit.net](http://tcm.msubmit.net)
- Send letters to the editor: [tcm@nctm.org](mailto:tcm@nctm.org)
- Access our home page: [www.nctm.org/tcm](http://www.nctm.org/tcm)
- Follow us on Twitter: [@TCM\\_at\\_NCTM](https://twitter.com/TCM_at_NCTM)
- Interact with authors and your fellow TCM readers on our blog: [www.nctm.org/tcm-blog](http://www.nctm.org/tcm-blog)

that adding different-size units does not make sense; when adding multi-digit numbers, they added ones to ones, tens to tens. Similarly, they can add halves to halves, thirds to thirds. If they need to add halves and thirds, they can partition the numbers into smaller units so that the addends are composed of same-size units.



### Subtraction

Students can separate, take away, find how much higher one number is than another, or find a missing addend using the same reasoning developed for fraction addition. They can also extend regrouping; previously students decomposed 100 into 10 tens in a subtraction problem. Now they might decompose 1 into  $\frac{5}{5}$  if more fifths are needed.



### Multiplication

In multiplication with whole numbers, the number of groups and the size of each group were known, and the product represented a total. Now the size of the group might be one-half of a sandwich, or the number of groups might be three-and-a-half pounds of bananas. Reasoning with visual models, students understand that multiplying by one-third is the same as dividing into three equal parts, thus extending the relationship between multiplication and division.



### Division

In division with whole numbers, a total was given, and the unknown was either the number of groups, given the size of each group, or the size of each group, given the


number of groups. Just as there are five two-cup servings in a ten-cup container, students can also reason that there are twenty half-cup servings. If an eight-pound bag gives each of four dogs two pounds of food, then a half-pound bag of food gives each of those four dogs one-eighth of a pound. A pitcher holding six cups will provide  $(6 \times 4)$  one-fourth-cup servings, and  $(6 \times 4) \div 3$  three-fourths-cup servings. Stories, visual models, and the multiplication/division relationship build understanding of the invert-and-multiply rule.


### Decimals


Decimals are first introduced as decimal fractions—that is, fractions whose denominators are 10 or 100—and rather than focus on rules for where to place

## Are you following TCM on Twitter?

Join your fellow *Teaching Children Mathematics* subscribers on Twitter. Our community of mathematics teaching professionals are sharing successes and discussing solutions to the same challenges you face on a daily basis. Join the conversation @tcm\_at\_NCTM.


**TeachingChildrenMath** @TCM\_at\_NCTM · Apr 26  
 Did your college of education program adequately prepare you for the challenges of the classroom? #TCMSoundOff [bit.ly/1o1IMC4](http://bit.ly/1o1IMC4)  
 Expand    Reply    Delete    Favorite    Pocket    More    HootSuite


**Sean Richmond** @Sean\_Richmond92 · 17h  
 @TCM\_at\_NCTM Being taught by master teachers and gaining first hand teaching experience made the TNT program at UNT beyond excellent. #kl35  
 Hide conversation    Reply    Retweet    Favorited    More    HootSuite  
 4:20 PM - 27 Apr 2014 · Details


**Shawna Mukavetz** @MukavetzSMM18 · Apr 26  
 @TCM\_at\_NCTM no, not even close. I actually use what I've figured out through trial&error, listening to my <3, and lots of web research.  
 View conversation    Reply    Retweet    Favorite    More    HootSuite



the decimal point, operations with decimals build on fraction reasoning.

The fraction progression describes a refreshing change from pieces of pie and operations as unexplained and isolated procedures, providing a roadmap that helps students incorporate fractions into their general understanding of number and operations.

## REFERENCES

Common Core State Standards Initiative (CCSSI). 2010. Common Core State Standards for Mathematics (CCSSM). Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers. [http://www.corestandards.org/wp-content/uploads/Math\\_Standards.pdf](http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf)

Common Core Standards Writing Team. 2013. Progressions for the Common Core State Standards in Mathematics (draft). Grades 6–8, The Number System; High School, Number. Tucson, AZ: Institute for Mathematics and Education, University of Arizona. [http://commoncoretools.me/wp-content/uploads/2011/08/ccss\\_progression\\_nf\\_35\\_2013\\_09\\_19.pdf](http://commoncoretools.me/wp-content/uploads/2011/08/ccss_progression_nf_35_2013_09_19.pdf) and [http://commoncoretools.me/wp-content/uploads/2013/07/ccssm\\_progression\\_NS+Number\\_2013-07-09.pdf](http://commoncoretools.me/wp-content/uploads/2013/07/ccssm_progression_NS+Number_2013-07-09.pdf)

Lisa Englard, [lisaenglard@yahoo.com](mailto:lisaenglard@yahoo.com), is a K–grade 8 math specialist in Aventura, Florida. Her latest project is a K–grade 5 mathematics professional development project to help teachers practice eliciting and diagnosing student thinking as well as providing effective feedback: <http://www.mytepd.com>.

The News & Views department is edited by **Holly Henderson Pinter**, [hhpinter@wcu.edu](mailto:hhpinter@wcu.edu), an assistant professor in the elementary and middle grades education department at Western Carolina University in Cullowhee, North Carolina.

# This is *not* your mother's mathematics

BY ROBYN SILBEY, PD AND CAMPUS CONSULTANT

For some of us who attended school in the twentieth century, mathematics was taught and learned as a collection of rules to be memorized and executed without question or examination. Topics were “covered” year after year, building ever so slightly on a teetering foundation until its eventual collapse—or until a teacher unlocked math’s mysteries.

The Common Core State Standards for Mathematics (CCSSM) (CCSSI 2010) calls for three key instructional shifts in mathematics that challenge both teachers and students to deeply understand the language and use of mathematics. Math coaches can work with teachers and parents alike to disseminate information about these instructional shifts.

## 1. Greater focus on fewer topics

Each grade level or course targets a finite, selected group of concepts for the entire year of study. Every concept is examined with deliberate care and in great depth. It is connected to other related concepts and applied in a variety of real-world, problem-solving situations. This increased focus allows time for students to develop a strong foundation with deep conceptual understanding, increased fluency, and the ability to use their knowledge both inside and outside the classroom.

## 2. Coherence

Linking topics and thinking across grades increases coherence. Standards are designed around a coherent progression from grade to grade. Each year’s new knowledge is a deliberate extension of the previous year’s learning. In addition, there is coherence in using complementary topics. For example, data displays are embedded as applications of other content topics, rather than as an isolated set of skills.

## 3. Rigor

Students pursue rigor in daily instruction. *Rigor* refers to deep command of content through equal parts of conceptual understanding, procedural skills and fluency, and application. Content must be developed from different perspectives, using a variety of approaches and strategies, so that it is understood rather than memorized. Core functions, such as basic facts, must be fluent for students to access increasingly complex concepts and procedures. Content must be applied to real-world, engaging contexts to foster motivation and provide relevance.

The Common Core Key Shifts ensure that the mathematics taught in classrooms motivates students to engage with the content and find its relevance in their daily lives. To read more, use the direct link below.

<http://www.corestandards.org/other-resources/key-shifts-in-mathematics/>

Questions, comments about this article? Contact [robyn@robysilbey.com](mailto:robyn@robysilbey.com).